may be applied. This needle is practically the only instrument used in the profession.

The height of civilisation in China was reached at the end of the reign of Kang-hi. The gradual decline is supposed to have commenced with the Tartar domination.

THE FLORA OF THE GALAPAGOS ISLANDS.

Dr. G. BAUR'S theory of the origin of the Galapagos Islands is too well known to need explanation here; yet it may be briefly designated the theory of subsidence. He argues that the islands were formerly connected with each other, and at an earlier period with the American continent. It is also almost needless to say that this theory has met with an exceedingly hostile reception; few indeed accepting it, even as restricted to a former union of the islands themselves. The publication of an account of the botanical collections[1] affords an opportunity of examining this theory from a botanical standpoint. For the purposes of the "Botany" of the *Challenger* Expedition, and ever since the publication of that work, I have collected all the data coming under my notice bearing on the dispersal of plants to considerable distances by wind, water, birds or other creatures excepting human. The evidence thus collected sufficiently accounts for the vegetation of low coral islands, and the littoral vegetation of widely separated countries; but it in no way helps to explain the vegetation of the enormously distant islands of the Antarctic seas, for example, or that of the islands of the Galapagos group, to give another instance.

But these are not parallel cases; they are the two extremes in the amount of differentiation in connection with isolation.

The biological phenomena of the Galapagos Islands left a deeper impression, probably, on the mind of Darwin than those of any other part of the world he visited, and doubtless had much to do with his later conception of the origin of species. The fact on which he laid special stress was that the genera, to a very great extent, were the same in all the islands, and the species different in each island. Dr. Baur's much more extensive zoological and botanical collections and observations confirm and emphasise the correctness of the view of his illustrious predecessor of fifty years ago. Darwin specially refers to the existence of different species or races of tortoises and mocking-thrushes in many of the islands; and Baur's examination of the lizards of the genus *Tropidurus*, from twelve of the islands, reveals the same condition of things. The botanists bring forward *Euphorbia viminea* in illustration of this phenomenon. This species was described by Sir Joseph Hooker from a single specimen collected by Macrae in Albemarle Island, and the author remarks that he "knew of no species with which to compare this highly curious one." Dr. Baur collected it extensively in eight of the islands, and the specimens from almost every one of them exhibit distinct racial characteristics. *Acalypha*, a genus of the same natural order, presents somewhat more pronounced variation in the different islands, which some botanists regard as of specific value; other botanists as of varietal value only. Whatever status we give these forms, the flora as a whole is a most instructive and convincing illustration of evolution.

A remarkable peculiarity of the Galapagos flora, as an insular flora, is the almost total absence of endemic genera, for the two or three genera of the Compositæ restricted to the islands are so closely allied to American genera as hardly to count as distinct. Indeed the whole flora is so thoroughly American that, apart from geological difficulties, it might be regarded as a differentiated remnant thereof, rather than derived therefrom, after the supposed elevation of the islands. Analogous conditions and phenomena are repeated in the deep valleys of the great mountain chains of northern India and western China, where, in neighbouring valleys, the genera are to a great extent the same and the species different.

Returning to Dr. Baur's extensive botanical collections from the Galapagos, it may be mentioned that they yielded about a dozen new species belonging to the predominating genera.

Looking at the composition of the Galapagos flora, especially with an eye to the probabilities of the transport of the seeds of its constituents, combined with present conditions, Dr. Baur's theory seems deserving of more serious consideration than it has hitherto received. My very slender knowledge of geology alone prevents me from taking up a more decided position.

W. Botting Hemsley.

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[1] B. L. Robinson and J. M. Greenman, in *American Journal of Science*, vol. l. pp. 135-149.

N.B.—Dr. G. Baur was attached to the United States Fish Commission steamer *Albatross*, and spent nearly three months in the islands, from June 10 to September 6, 1891.

THE LATE PROFESSOR HOPPE-SEYLER.[1]

II.

Hoppe-Seyler's Work in Berlin, 1850-54 *and* 1856-61.

It has already been stated that Hoppe selected as the subject of his inaugural dissertation some observations on the structure of cartilage and on chondrin.[2] Chondrin had been first separated and examined by Johannes Müller,[3] and afterwards by Mulder and Donders. Pursuing his study of the chemical reactions of the so-called chondrin, Hoppe in 1852[4] described its lævo-rotatory property, and showed that when decomposed by long boiling with dilute mineral acids it yields leucine, but neither glycocine nor tyrosine. Still directing his attention to the connective tissues, Hoppe in the following year published a valuable and interesting paper[5] on the structural elements of cartilage, bone, and tooth. Virchow had shown[6] the possibility of isolating the so-called bone corpuscles. Hoppe now alleged facts which seemed to prove that the lacunæ and canaliculi of bone are lined by a tissue resembling elastic tissue, and are left surrounding the bone cells when decalcified bone is boiled in a Papin's digester. Extending his investigation to tooth, Hoppe studied the chemistry of the organic basis of dentine, and isolated the "dentinal sheaths," which he showed to correspond structurally and chemically to the more internal portion of the ground substance of bone, which may be separated as a distinct investment bordering the lacunæ, canaliculi, and Haversian canals. There can be no question of the important bearing which these early histologic-chemical researches had upon the development of our knowledge of the relations and affinities of the connective tissues; attention has been drawn to them for this reason, as well as because they differed somewhat in their scope and method from the work with which Hoppe afterwards mainly busied himself.

Passing over three interesting papers on auscultation[7] and communications of minor importance on chemical questions relating to physiology and pathology, we come to the first in the long series of valuable contributions which Hoppe made to the physiological chemistry of the blood. This short paper of only two pages was published in 1857, after his return to Berlin, and consisted of a preliminary communication on the action of carbonic oxide on the blood.[1] In this paper he announced that carbonic oxide so affects the colouring-matter (at that time designated Hämatoglobulin by Hoppe) as to render it incapable of fulfilling the function, so important for the blood as well as for the whole organism, of acting as the carrier of oxygen. Simultaneously and independently, Claude Bernard[2] had observed the same facts as Hoppe, and had shown, in addition, that when carbonic oxide acts upon blood it is absorbed and displaces oxygen. Although his analytical data did not bear out the assertion, Claude Bernard stated that for each volume of oxygen displaced one volume of carbonic oxide is absorbed, a relation which was afterwards shown to be actually correct by the fine investigation of Lothar Meyer.[3] As will be afterwards stated, it was, however, Hoppe-Seyler who, in 1865, after Stokes' beautiful researches on the reduction of oxy-hæmoglobin, furnished the complete explanation of the way in which carbonic oxide exerts its action on the blood and its colouring-matter, and placed in the hands of the medical jurist a method of distinguishing between blood which has been rendered florid by carbonic oxide and blood which owes its red arterial colour to oxygen.

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[1] In the fragmentary notes which follow, I do not pretend to give a complete or entirely consecutive account of Hoppe-Seyler's labours; my object is to draw attention to some of the principal results of his life-work, and to indicate in this way his position among those who, during the last half-century, have contributed to the advancement of biological science.—A. G.

[2] F. Hoppe, "De Cartilaginum Structura et Chondrino nonnulla," Diss. Inaug. Berol. 1850.

[3] Joh. Müller, *Poggendorff's Annalen*, vol. xxxviii. (1836) pp. 295-356.

[4] Hoppe "Ueber das Chondrin und einige seiner Zersitzungsproducte," *Journ. f. Prakt. Chemie*, vol. lvi. (1852) p. 129.

[5] Hoppe, "Ueber die Gewebselemente der Knorpel Knochen und Zähne,' Virchow's *Archiv*, vol. v. (1853) p. 170.

[6] Virchow, "Verhandl. d. Phys. Med. Gesellschaft zu Würzburg," vol. ii. p. 152.

[7] Virchow's *Archiv*, vol. vi. (1854) pp. 143-173, vol. vi. (1854) pp. 331-349; vol. viii. (1855) pp. 250-259.

The year 1857 witnessed also the publication of the first[4] of a series of researches on the property which many of the proximate principles of the body possess of rotating the plane of polarisation. Biot had discovered that albumin rotates the plane of polarisation to the left, and Bouchardat and A. Becquerel had endeavoured, but without success, to base upon this discovery a method for the quantitative estimation of albumin. In his first paper Hoppe showed (1) that, as was to be predicted, the rotation produced by a solution of albumin was strictly proportional to the amount of albumin in solution, and to the thickness of the stratum traversed by the light; (2) that albumin existing in a state of solution in a liquid rotates the plane of polarisation of light almost exactly as much to the left as an equal percentage of grape sugar rotates it to the right. In the same year (1857) and the year following, Hoppe published other papers on the rotatory properties of other organic proximate principles of the animal body.[5]

With his hands full of original work, with the chemical laboratory of the Pathological Institute to direct, busily helping the students who were attracted to work under a teacher full of enthusiasm and ability, Hoppe yet found time to publish, in 1858, the first edition of his "Handbook of Physiologico-Chemical and Pathologico-Chemical Analysis."[6] The only work at that time in existence which fulfilled the same object was the very useful work of Gorup-Besanez, of which the first edition appeared in 1850, the second in 1854,[7] and the third and last in 1871. Hoppe-Seyler's book was written on lines essentially the same, but was distinguished by containing many new methods, the results of the original researches of its author; as, for example, on the rotatory properties of various origanic bodies, on the polarimetric estimation of albumin and milk-sugar, on the colorimetric estimation of the blood-colouring matter, on new methods of blood analysis, &c. Personally, the writer is greatly indebted to the first and the subsequent editions of Hoppe-Seyler's work, and in saying that it has exerted a powerful and useful influence in diffusing a knowledge of the best methods of practical work throughout the laboratories where researches in physiological chemistry are pursued, he is only expressing an opinion which he believes to be shared by all who are best qualified to judge. In spite of a decided narrowness, amounting at times to unfairness, which asserts itself in nearly all Hoppe-Seyler's writings, and which caused him to attach undue importance to his own work and that of his own pupils, and which explains some unfortunate omissions and deficiencies, the "Handbook" remains the recognised practical work consulted by the student of physiological chemistry. The sixth, and last, edition of the book,[1] edited jointly by Hoppe-Seyler and his pupil Dr. Thierfelder, appeared early in 1893.

Hoppe-Seyler's Work in Tübingen, 1861–72.

With his appointment as ordinary Professor of Applied Chemistry in the University of Tübingen commenced the most prolific period of Hoppe-Seyler's scientific life, during which he contributed to science his researches on hæmoglobin and its derivatives—researches which, with the work of Stokes, Claude Bernard, Pflüger, Ludwig and his school, have furnished us with the greater part of the knowledge which we at present possess concerning the chemistry of the blood-colouring matter and the part which it plays in respiration. At Tübingen, Hoppe, then in the very prime of life, surrounded by pupils, amongst whom were Diakonow, Dybkowsky, Miescher, Parke, and Salkowski, showed much more clearly than was possible in the position which he occupied in Berlin, his capacity to be the head of a school—that is, his power of inducing men to work out his own ideas, and of animating them with the desire to advance science by their own researches.

It was in 1862 that appeared Hoppe's short but epoch-marking paper "On the behaviour of the blood-colouring matter in the spectrum of sunlight."[2] Through the researches of Brewster and Herschel, the fact that absorption bands occurred in the spectrum of light which had been passed through certain coloured gases, vapours, and diluted coloured solutions had become known, and the absorption spectra of indigo and chlorophyll had been described. The discovery of the wonderfully characteristic absorption spectrum of blood at once enabled Hoppe to assert that hæmatin, which had up to that time been by many considered the true blood-colouring matter, did not exist preformed in the blood corpuscles, but that it is a product of decomposition of the true blood-colouring matter which is the cause of the absorption bands which he had discovered, and which, under the influence of heat, acids, &c., splits up into hæmatin and an albuminous substance. Without doubt, added Hoppe, the true blood-colouring matter is the body which forms the blood crystals of Funcke, and these crystals are not, as Lehmann had erroneously supposed, composed of a colourless albuminous *hæmatocrystalline* stained with hæmatin.

There can be no question that Hoppe at once appreciated the immense value of the information which he had acquired by his study of the spectrum of blood, though the full light which it was destined to throw on the function of the blood-colouring matter was only recognised when Stokes published his paper "On the Reduction and Oxidation of the Colouring-matter of the Blood." Having described the beautiful experiments which he had performed after becoming acquainted with Hoppe's paper on the blood spectrum, Stokes stated the conclusions, which might legitimately be drawn from them in the following words: "We may infer from the facts above mentioned that the colouring-matter of blood, like indigo, is capable of existing in two states of oxidation, distinguishable by a difference of colour and a fundamental difference in the action of the spectrum. It may be made to pass from the more to the less oxidised state by the action of suitable reducing agents, and recovers its oxygen by absorption from the air."[1]

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[1] Hoppe, "Ueber die Einwirkung des Kohlenoxydgases auf das Hämatoglobulin. Vorläufige Mittheilung," Virchow's *Archiv*, vol. xi. (1857) p. 288.

[2] Claude Bernard, "Leçons sur les effets des substances toxiques et médicamenteuses." Paris, 1857, see p. 158.

[3] Lothar Meyer, "De sanguine oxydo carbonis infecto," Dissert. Inaugurat. Chymica. Vratislaviae, 1858.

[4] Hoppe, "Ueber die Bestimmung des Eiweissgehaltes im Urin, Blutserum, Transudaten mittelst des Ventke-Soleilschen Polarisations-Apparates," Virchow's *Archiv*, vol. xi. (1857) pp. 547-560.

[5] (*a*) "Ueber die Circumpolarisationsverhältnisse der Leim und Gallen Substanzen," Virchow's *Archiv*, vol. xii. (1857) p. 480; (*b*) "Bestimmung des Milchzuckergehaltes der Milch mittelst des Soleil-Ventke'schen Polarisationsapparates," Virchow's *Archiv*, vol. xiii. (1858) p. 276; (*c*) "Ueber die Circumpolarisirende Eigenschaft der Gallensubstanzen und ihre Zersetzungsproducte," Virchow's *Archiv*, vol. xv. (1858) pp. 126-141.

[6] I unfortunately have not by me this first edition, which I long treasured as my constant guide. If I remember rightly, the title of the first edition was "Anleitung zur Pathologisch-Chemischen Analyse."

[7] E. von Gorup-Besanez "Anleitung zur qualitativen und quantitativen Zoochemischen Analyse." (Nürnberg, Verlag v. L. Schrag, 1854.)

[1] "Handbuch der Physiologisch- und Pathologisch-Chemischen Analyse für Aerzte und Studirende," von Felix Hoppe-Seyler. Sechste Auflage neu bearbeitet von F. Hoppe-Seyler, Professor in Strassburg, und H. Thierfelder, Privat-docent in Berlin. (Berlin, Verlag von Aug. Hirschwald, 1893.)

[2] Prof. Felix Hoppe in Tübingen, "Ueber das Verhalten des Blutfarbstoffes im Spectrum des Sonnenlichtes," Virchow's *Archiv*, vol. xxiii. (1862), pp. 446-449.

The new facts acquired by the combined use of chemical and optical methods at once explained a large number of facts. Hoppe-Seyler showed that carbonic oxide blood was distinguished from normal blood in being unacted upon by reducing agents, and thus placed a valuable test in the hands of the medical jurist called upon to investigate cases of death by charcoal fumes.[2] The explanation of the facts discovered by Claude Bernard and by Lothar Meyer was obvious—to wit, that carbonic oxide forms a compound with the blood-colouring matter, more stable than the oxygen compound, and in which apparently one molecule of CO has replaced O_2.

With the resources of spectrum analysis to aid him, Hoppe now devoted himself with energy to the investigation of the blood-colouring matter (which he named Haemoglobin [3]), showing how to separate and purify it by repeated crystallisation, determining its composition, studying personally, and, with the aid of his pupil Dybkowsky, its combinations with oxygen and with carbonic oxide, examining its products of decomposition, and showing its probable connections with certain other animal colouring matters.[4]

It would be impossible in this place to comment in detail on all Hoppe-Seyler's contributions to the chemistry of the blood-colouring matter; these constitute his highest claim to distinction, and will ever cause him to be remembered as having contributed most largely to our knowledge of the manner in which the respiratory exchanges of animals are effected.

Until he removed from Berlin to Tübingen, and for some time after, Hoppe-Seyler published his researches for the most part in Virchow's *Archiv*, some of his papers appearing, however, in Fresenius' *Zeitschrift*, in the *Annalen d. Chemie und Pharmacie*, and in the *Berichte* of the Chemical Society of Berlin. In 1866, however, he commenced the publication of the collected papers issuing from his laboratory, under the title of "Med.-Chemische Untersuchungen."[5] Four parts of this publication appeared, the last in 1871.

Hoppe-Seyler's Work in Strasburg, 1872–1895.

A proper estimate of Hoppe-Seyler's work would necessitate a careful review of the fine researches published by his pupils, for there can be no doubt that in his case, as in that of many of the most distinguished scientific men of Germany, the work of the master has often been credited to the pupil under whose name it has appeared. It is obvious, however, that it would be impossible, within the limits of such an article as the present one, to give an account, however brief, of the succession of valuable papers which issued from the new Physiologico-Chemical Institute of Strasburg. Two events in Hoppe-Seyler's scientific life in Strasburg cannot, however, be passed over, viz. the publication of his "Text-Book of Physiological Chemistry," and the foundation of the *Zeitschrift für Physiologische Chemie*. The first part of the "Text-Book of Physiological Chemistry" appeared in 1877, the second in 1878, the third in 1879, and the fourth in 1881. This work is of interest as giving Hoppe-Seyler's views of the chemical processes of the body; yet it neither achieved nor merited great success. Devoted though he was to work by which he unquestionably did much to advance both physiology and pathology, Hoppe-Seyler was essentially a chemist rather than a biologist; and when, as in his systematic treatise, he left chemical, to speculate on biological, questions, his weak points became very obvious.

This account of Hoppe-Seyler's work must close with a reference to the great service which he rendered to our branch of science by founding, in 1877–78, the *Zeitschrift für Physiologische Chemie*. From the first number to the last this periodical has maintained a high standard, and, besides containing the results of all the work done in the Strasburg Laboratory, it has received contributions from nearly all the prominent workers in physiological chemistry. In succession to Hoppe-Seyler, Professors Baumann and Kossel are, it is understood, to be the future editors of this journal.

ARTHUR GAMGEE

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[1] Prof. Stokes, F.R.S., "On the Reduction and Oxidation of the Colouring-matter of the Blood." *Proceedings* of the Royal Society, vol. xiii. (1864) p. 357, paragraph 8.

[2] Hoppe-Seyler, "Erkennung der Vergiftung mit Kohlenoxyd." Fresenius' *Zeitschrift*, vol. iii. (1864) p. 439. *Philosophical Magazine*, vol. xxx. (1865) p. 456.

[3] "Um Verwechselungen zu vermeiden nenne ich den Blutfabstoff Hämatoglobulin oder Hämoglobin," Virchow's *Archiv*, vol. xxix. (1864) p. 233.

[4] Hoppe-Seyler's "Beiträge zur Kenntniss des Blutes des Menschen und der Wirbelthiere"; "Med-Chem. Untersuchungen," pp. 169-214, 366-385, 523-550; "Zur Chemie des Blutes und seiner Bestandtheile," *ibid.*, pp. 29-300; Dybkowsky, "Einige Bestimmungen über die Quantität des mit dem Hämoglobinlose gebundenen Sauerstoffs," *ibid.*, p. 117-132.

[5] "Medicinisch-Chemische Untersuchungen aus dem Laboratorium für angewandte Chemie zu Tübingen herausgegeben, von Dr. Felix Hoppe-Seyler." Berlin, 1866.

NOTES.

WE are informed that a biography of Prof. Huxley is being prepared by his son, Mr. Leonard Huxley, who will be greatly obliged if those who possess letters or other documents of interest will forward them to him at Charterhouse, Godalming. They will be carefully returned after being copied.

THE Committee of the Pasteur Institute have appointed Dr. Duclaux, formerly sub-director, to succeed M. Pasteur as director, and Dr. Roux to be sub-director of the Institute.

WE understand that the final interment of M. Pasteur in the Pasteur Institute will not take place on Friday, as had been intended, because the vault and part of the sculpture cannot be ready in time.

THE centenary celebrations of the Institute of France commenced as we went to press yesterday, and will terminate on Saturday by a visit to the fine chateau of Chantilly, where the associates and members will be received by the Duc d'Aumale. An account of the foundation and membership of the Institute appeared in these columns a few weeks ago, and we hope to give in our next issue a full description of the ceremonies now taking place.

A BRONZE portrait bust of Dr. Robert Brown was unveiled on Friday in his native town, Montrose, Forfarshire, at a reception held by the Provost, magistrates, and town council of Montrose. Beneath the bust is a tablet, with the following inscription:—"Robert Brown, D.C.L. Oxon., LL.D. Edinburgh, F.R.S. London, President of the Linnean Society, Member of the Institute of France. Born in this house 21st December, 1773; died in London 10th June, 1858. 'Botanicorum facile princeps,' Alex. Von Humboldt.'" A large number of distinguished botanists from all parts of the kingdom were present.